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DEPARTMENT OF COMMERCE

UNITED STATES BUREAU OF MINES
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TOPAZ

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

TOPAZ[1]

By I. Aitkens[2]

CONTENTS

	Page
Introduction	1
Description and properties	2
Uses	2
Identification	2
Substitutes	3
History	3
Mode of occurrence	3
Mining methods	3
Domestic production	4
Domestic deposits	4
The industry in foreign countries	8
Selected references	10

INTRODUCTION

It is a common misconception that all yellow stones are topazes and that all topazes are yellow; but neither statement is true. The real topaz is a rather rare mineral, and a large number of yellow stones that masquerade as topaz are nothing more than yellow quartz, known as citrine, but almost universally called topaz. The true topaz is often called "Brazilian" topaz by the jeweler to distinguish it from yellow quartz; nevertheless, both terms are freely applied in trade to other yellow stones.

Topaz is considered the most popular yellow stone for jewelry and is often used as the principal stone in brooches or pendants, especially in old-fashioned ornaments. However, many other species yield pretty yellow stones, some of which are far more numerous and less costly than the topaz.

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DESCRIPTION AND PROPERTIES

Topaz, is a crystalline gem. Chemically it is a fluosilicate of aluminum, in which the fluorine is in part replaced isomorphously by hydroxyl, with the resulting formula, $(Al[F.OH])_2 SiO_4$. Due to this variability in chemical composition the specific gravity varies from 3.4 to 3.6. True or Brazilian topaz has a hardness of 8 on Moh's scale, and is noted for its hardness; very few minerals are harder. It will cut quartz and tourmaline easily, but is very brittle.

Topaz crystallizes in the orthorhombic system, and occurs in prisms with one end regularly terminated. It has a perfect cleavage transverse to the prisms. In contradiction to quartz the prism faces are striated vertically, whereas those of quartz are striated horizontally. Doubly terminated crystals are rare.

When pure the crystals are often perfectly colorless and water-clear, but due to the presence of impurities they may show a wide range of colors--red, yellow, brown, green, or blue. It is an interesting fact that these colors are by no means stable. The brown and wine-yellow fade upon exposure to light, and the sherry-yellow crystals from Brazil assume a fine pink color upon being heated.

USES

Clean, transparent topaz crystals of good color are used as gem stones. Its principal use is for jewelry, but ground topaz is used to a small extent as an abrasive. Powdered topaz is frequently used instead of emery powder for grinding agate, jasper, chalcedony, and other gem minerals.

IDENTIFICATION

Topaz is recognized chiefly by its crystals, its basal cleavage, its hardness, and high specific gravity. It is readily distinguished from citrine because it is harder and heavier. Topaz will scratch citrine and it sinks rapidly in methylene iodide, in which citrine floats. Its perfect cleavage serves to distinguish it from many other precious stones. The cleavage is in only one direction, parallel to the basal plane.

A remarkably clear, colorless transparent crystal might be taken for a diamond, were it not for the fact that it is not nearly so hard and has a much weaker double refractive and dispersing power. In specific gravity, however, topaz ranks close to the diamond.

Topaz is 30 per cent heavier than quartz and is easily distinguished from the common yellow gems beryl, tourmaline, and peridot, which are lighter, and from corundum and garnet, which are heavier.

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The minerals commonly called topaz are: the topaz proper; the yellow sapphire known as the "oriental topaz"; and certain quartz minerals known as "Saxon," "Scotch," "Spanish," "smoky," and "false topaz." However, these stones vary widely in hardness and specific gravity as shown by the following table:

	Hardness	Specific gravity
Oriental topaz.....	9	4.01
True topaz.....	8	3.53
Scotch topaz, etc.	7	2.65

SUBSTITUTES

There is very little commercial advantage in manufacturing artificial topaz, since other natural yellow stones are far less expensive and are easier to cut. This accounts for several minerals being commonly called topaz in trade. The principal substitutes to which the name of topaz may be given are yellow quartz, or citrine, and smoky quartz, which are sold as Scotch topaz, false topaz, or smoky topaz, respectively. On the other hand, pink, rose, blue, and greenish topazes, although less common than the yellow variety, are often used in imitation of the more expensive corundum gems. Pink topaz is produced by heating yellow topaz.

HISTORY

The name topaz comes from the Greek word, topazion, meaning to seek. It was applied to gems from an island in the Red Sea, the whereabouts of which were finally located only after some difficulty. Pliny and his contemporaries applied the name to the yellowish peridot found there. In the Middle Ages the term was loosely applied to any yellow stone, but gradually it has been narrowed down to present usage.

MODE OF OCCURRENCE

Since it is usually associated with cassiterite in granitic rocks, topaz is considered a valuable indicator of tin ore. Other minerals commonly associated with it are tourmaline, quartz, fluorite, apatite, beryl, and tungsten ores.

According to Dana, topaz occurs in cavities of rhyolite lavas and granite; in pegmatite veins, especially those carrying tin; and at times is also found as rolled pebbles in stream sands (placer deposits). It is formed through the agency of fluorine-bearing vapors given off during the last stages of the solidification of igneous rocks.

MINING METHODS

In Brazil the principal mine- the Boa Vista- had been worked for many years by open-cut methods. A pit was first dug for some distance down into the overburden formed by slides and the caving of the decomposed inclosing

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rock, and from the bottom of this excavation small inclined shafts were sunk to reach the topaz-bearing deposit. By this method the gem-bearing clay could be followed down some meters below the drainage level, but the mine could not be worked successfully except during the dry season.

In 1908 when these old topaz mines were reopened, deep mining methods were employed at this property and have been introduced also into other localities in Brazil.

The presence of water within a few feet of the surface has likewise hindered the working of prospects in the United States. In this country the pits were ordinarily from 8 to 15 feet deep and about 25 feet wide.

DOMESTIC PRODUCTION

The production of topaz in the United States has never been large. Although the mineral is widely distributed through the States, crystals of gem quality are somewhat rare. The majority of domestic stones are colorless, but some fine blue and bluish-green crystals have been found. Production statistics for the United States are not available, however, after 1921, when the United States Geological Survey discontinued the canvass of producers.

Table 1.- Value of topaz produced in the United States, 1906-1921[1]

Year	Value	Year	Value	Year	Value
1906	$1,550	1912	$ 375	1918	$ 907
1907	2,300	1913	736	1919	210
1908	4,435	1914	1,380	1920	767
1909	512	1915	862	1921	2/
1910	884	1916	1,005		
1911	2,675	1917	230		

1/ Compiled from Mineral Resources of the United States. Part II. (annual chapters). 2/ Less than three producers; figures not published separately

DOMESTIC DEPOSITS

Crystals from Harndon Hill, in the vicinity of Stoneham, Maine, were identified as topazes in 1882 and among the more important subsequent finds may be mentioned: on Baldface Mountain, near North Chatham, N. H., in 1888; in San Diego County, Calif., about 1903; in Mason County, Tex., in 1904. None of these deposits nor others in Maine, Colorado, and Utah have ever been worked except intermittently. Topaz has been found also in Georgia, Idaho, Montana, and Wyoming.

California

In California, topaz deposits were discovered 4 miles from Ramona in San Diego County. This locality produced rich gems as well as forms suitable for beautiful cabinet specimens. These came principally from the Little Three mine.

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The Mountain Lily Gem Mine on Smith or Aquanga Mountain in San Diego County also produced some large topaz crystals. One of these, a decidedly green stone, weighed 3¼ pounds and exhibited a number of crystal faces. This topaz was found with other greenish and white topaz crystals in a pegmatite ledge. Tourmaline was found in pockets in the same ledge but not in the same pockets as the topaz. A part of the 3¼-pound crystal was transparent and of good gem material. Some time later, 30 crystals of bluish topaz were taken from the Mountain Lily mine, near Oak Grove in San Diego County.

Georgia

About 1913, two gems were cut from crystals found in the Williams mica mine near Two Run, Ga. One of these turned out to be ordinary quartz, but the other proved to be colorless topaz. This was found inclosed in a cavity in a large crystal of mica, a new locality for topaz and an unusual mode of occurrence.

Idaho

White topaz was discovered about 1919, at City of Rocks, 5 miles northwest of Moulton, Cassia County, Idaho. This mineral was cut into stones of 1 to 3 carats and is said to resemble the diamond. Stones exhibited by the owner of these claims were exceptionally clear and could cut glass like a high-priced diamond would.

Maine

According to Kunz[3] most of the topaz crystals from Harndon Hill, in the southwest corner of the town of Stoneham, Me., were found in one pocket with clevelandite. These stones ranged in size from quite small crystals to large, rough, opaque masses, weighing 10 to 20 kilograms. Some were transparent only in parts, while the better crystals were colorless or faintly tinted with green or blue and measured 10 to 60 millimeters across. This locality has been described by E. S. Bastin.[4]

Montana

In 1920 topaz was found about 18 miles southeast of Butte, Mont. Sufficient work was done on these claims to prove that it was good gem material.

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3 - Kunz, Geo. F., Topaz and Associated Minerals at Stoneham, Me.: Am. Jour. Sci., 3d ser., vol. 27, 1884, pp. 212-216.

4 - Bastin, E. S., Geology of the Pegmatites and Associated Rocks of Maine: U. S. Geol. Survey Bull. 445, 1911, pp. 100-102.

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New Hampshire

According to Kunz,[5] in May, 1888, E. A. Andrews discovered topaz on Baldface Mt., about 4 miles northwest of North Chatham, N. H. No systematic mining for topaz and associated minerals was done for some time, although occasional crystals were picked up by prospectors and mineral collectors working only a few days at a time. Later, however, considerable systematic prospecting was done on Baldface Mt. by John Chandler of North Chatham.

In this locality the topaz occurs in crystals up to more than an inch thick. Some perfectly transparent crystals were found, but the majority of them were merely translucent or were transparent only in places. Although some of these stones were suitable for gems, most of them were worth more as specimens because of the perfection of the crystals. They ranged in color from colorless to pale bluish-green, but some were yellow from iron stains on the surface.

Texas

In 1904 an important deposit of gem topaz was accidentally discovered in Mason County, Tex., by R. L. Parker of Streeter. Since then, topaz has been found near Streeter and also near Katemcy, in Mason County, the former is 8 miles due west and the latter 12 miles north of Mason, the county seat.

Meyer[6] has described the deposits of topaz in Mason County, Tex. An interesting discovery made by Meyer was that stream tin or cassiterite was associated with the topaz in the concentrates from the dry placers. The tin mineral was found in broken crystals and angular grains of resin-yellow to brownish-black color.

According to Meyer, the topaz occurs in pegmatite, but with different associations at the two localities. Near Streeter the crystals are found associated with microcline, feldspar, biotite, tourmaline, smoky quartz, and albite. Some 200 pounds of good topaz crystals had been obtained, and besides the clear, colorless crystals a small number of beautiful light-blue ones had been found. Meyer describes the largest crystal found here as about 3 inches in diameter with a faint greenish-blue color.

At the deposit near Katemcy, the topaz is intimately associated with quartz and feldspar, and the interstices are filled with a reddish felsitic rock. These crystals range up to an inch or more in thickness and are frozen in the rock. Meyer further states that about 80 per cent of the

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5 - Kunz, Geo. F., Gems and Precious Stones of North America: New York, 1890, p. 70.

6 - Meyer, H. Conrad, Topaz and Stream Tin in Mason County, Texas: Eng. and Min. Jour., Mar. 8, 1913, pp. 511-512.

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mass of this rock is topaz, but that a much smaller proportion of the topaz from this place is suitable for gem purposes than at the other locality.

Utah

Although in 1859, a geologist, Henry Engelmann, first discovered the occurrence of topaz in the Thomas Range, Utah, little was heard of this region until 1884. Numerous specimens were collected at this time by Prof. J. E. Clayton of Salt Lake City, and collectors have since visited the locality and brief descriptions have been written. The following notes have been abstracted from an article by Horace B. Patton[7] on the occurrences in the Thomas Range.

These deposits are 40 miles north of Sevier Lake and a little over 40 miles northwest of Deseret. This locality is known as Topaz Mountain and is that portion along the southeast side where topaz crystals have been found most abundantly. The rocks of this portion of the Thomas Range are of volcanic origin and the only sedimentary rock exposed near this location is a bluish-gray limestone.

The three types of crystals from this locality are (1) fine transparent crystals which occur principally in lithophysae cavities; (2) rough opaque crystals which occur scattered through the solid rhyolite; and (3) smooth opaque crystals which are similar to the rough opaque, except that the faces are smooth and better developed.

These topaz crystals are present over a large area, but abundant over a limited area only. Weathering of the topaz-bearing rhyolite has left many crystals scattered over the surface; most of them are very small but brilliant. A few large transparent crystals are found, but the tiny ones shine so brilliantly in the sunlight as to make it difficult to locate the larger crystals.

According to Alling[8] the transparent crystals make very brilliant gems, when found of sufficient size for cutting. These are perfectly colorless and are sold mostly as souvenirs to tourists under the name of "white topaz." They are also highly prized for collection specimens on account of their transparency and the quality of the crystal faces.

Wyoming

Crystals of topaz were obtained from the headwaters of Bighorn River in northern Wyoming. These displayed a development of a number of faces including prisms, pyramids, domes, pinacoids, and base. Though mostly small, all of these crystals were transparent and colorless, resembling in quality

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7 - Patton, Horace B., Topaz-bearing Rhyolite of the Thomas Range, Utah: Bull. Geol. Soc. Am., vol. 19, 1908, pp. 177-192.

8 - Alling, A. N., Topaz from the Thomas Range, Utah: Am. Jour. Sci., 3d ser., vol. 33, 1887, p. 146.

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the colorless topaz from the Thomas Range, Utah. These are of interest as specimens because of their quality and sharp crystal form, but would not have much value as gems except for local souvenir trade.

THE INDUSTRY IN FOREIGN COUNTRIES

Brazil and Ceylon are the two principal sources of topaz to-day. However, topaz of fine gem quality has been produced in small quantities in many other localities. Fine blue and sherry-colored crystals have been found in Siberia; blue ones in Scotland and Ireland; blue and white ones in Ceylon; good crystals of pale blue and green colors have come from the Ural Mountains and from Nerchinsk in Siberia; and some of a rare reddish hue have come from Russia. A large, rough crystal weighing 137 pounds of opaque topaz was obtained from a feldspar quarry in Norway. Australia, Japan, and Mexico have also produced topaz of gem quality.

Brazil

The principal localities in Brazil are, Ouro Preto, Villa Rica, and Minas Novas in the State of Minas Geraes. At all of these places stones of lovely shades of blue and wine-yellow occur. Reddish stones also have been found in Ouro Preto. The sherry-yellow crystals used so extensively in jewelry and for which Brazil has become noted, have come mostly from the neighborhood of Ouro Preto, and is that material which supplied the pink ("burnt") topaz. Orville Derby[9] has described the occurrences near Ouro Preto, Brazil.

According to Kunz,[10] one of the largest single pieces of topaz in the world has been added to the Smithsonian Institution collection from Brazil. This piece weighs 95 pounds. At least six sections of transparent topaz of a very pale yellow or white have come to the United States from Brazil; three of these pieces apparently fitted together and formed a crystal of at least 300 pounds.

Ceylon

In Ceylon, topaz is fairly abundant, but the bright yellow variety is almost entirely absent. The true topazes are either colorless or light green, but occasionally pinkish-yellow or yellow-brown stones are also found. The colorless variety is frequently cut and sold under the name of water-sapphire, but the name is entirely misapplied, as the true water-sapphire is blue; green stones are sold with true beryls as aquamarines; the yellowish-pink stones closely resemble the pink stones of Brazil, but with the curious difference that while the Brazilian stones turn to a clear pink on being heated, the Ceylon stones are absolutely decolorized by heat.

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9 - Derby, Orville A., Topaz near Ouro Preto, Brazil: Am. Jour. Sci., 4th ser., vol. 11, Jan., 1901, pp. 25-34.

10 - Kunz, Geo. F., Precious and Semi-precious Stones: Min. Ind., 1926, p. 586.

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Burma

Some unusually fine specimens have come from the great pegmatite dike at Sakangei, Burma. According to Kunz,[11] one particular crystal of a rich cinnamon-brown, beautifully crystallized, came from this locality. This crystal weighed 1088.5 grams (35 troy oz.), and measured 95 millimeters in width, 90 millimeters in depth, and 82 millimeters in height. Doubly terminated crystals have also been found in this locality. Adams and Graham[12] have described the topaz occurrences at Sakangei, Burma.

Australia

Topazes of gem quality have been found in Western Australia, Tasmania, and New South Wales. About 1902, E. L. Simpson,[13] mineralogist of the Geological Survey of Western Australia, announced the discovery of topaz in Western Australia. This deposit was found in the Coolgardie gold field near the town of Londonderry and in a dike of very coarse pegmatite, traversing amphibolite rock. The stones procured here were so light in color as to appear like white topazes.

In Tasmania the well-known localities for topaz are Mount Cameron, Flinders Island, and Bell Mount. Tasmania is noted for its remarkably fine water-clear topaz. These stones are cut and polished for ornamental purposes. Topaz also occurs here in shades of sea-green and blue. Some of the crystals from Flinders Island are of remarkable size, up to several inches in diameter.

The principal deposits of New South Wales are to be found at Emmaville and Oban. These deposits are described and detailed accounts are given in the Records of the Australia Museum by Anderson.[14]

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